

## NETWORK MANAGEMENT STANDARDS

### STANDARDS

There are two types of standards that are needed to implement a shared statewide trunked radio system. The first is the “network architecture” standards. For the purpose of this document this standard is defined as Project 25, described later in this section. The second required standard involves the operation and administration of the system. These standards will establish the protocols, and procedures for users of the system. The topics covered by the standards manual will include, but not limited to, the areas listed below. While most standards have already been written, they are too lengthily to include in this document.

### PROTOCOL & PROCEDURES STANDARDS

1. Management
  - a. Agency roles in operational management of system
  - b. Network management
  - c. Database management
  - d. Maintenance of names and naming standards
  - e. Changing policy & standards
  - f. Security
  - g. Equipment standards
  - h. Moves, additions and changes
  - i. Managing participation issues
  - j. Training standards
2. Configuration and Allocation
  - a. Naming conventions
  - b. Talk-group and radio ID allocations
  - c. Fleet-mapping standards
  - d. Use of shared Talk-groups
  - e. Talk-group & radio user priorities
  - f. Telephone interconnect
  - g. Subsystem roaming
  - h. Scanning
  - i. Recording/Logger ports
  - j. Private call
  - k. Status & message transmission/warning signals/AVL/text messaging
  - l. Emergency button
  - m. Multi-group announcement
3. Interoperability Guidelines
  - a. MINSEF
  - b. Statewide Fire Mutual Aid
  - c. MIMS
  - d. Statewide EMS
  - e. Recording common interagency Talk-groups
4. Guidelines for Project 25 Trunked Users
  - a. Talk-group and Multi-group ownership
  - b. Interoperability between statewide 800 MHz system and other 800 MHz systems

- c. Statewide tactical Talk-groups
- d. Interoperability between statewide 800 MHz and federal agencies
- 5. Guidelines for Conventional Users
  - a. Connecting into the Interop System
  - b. RF control stations and portables
  - c. Radio to radio cross band repeaters
- 6. Maintenance
  - a. Agency maintenance plans
  - b. Develop standards for preventive maintenance
  - c. Record-keeping requirements
  - d. Contact information & procedures
  - e. Spare equipment
  - f. Equipment configuration information
  - g. Software location
  - h. Notification of maintenance activities
  - i. Outage responsibility/Time standards/Repair Standards
- 7. Media Policy
  - a. Media access to Talk-groups
  - b. Selling radios to the media
  - c. Programming media radios
- 8. Agency Billing & Cost Allocation
  - a. New Users
  - b. Fees for service
  - c. Operational costs
  - d. Billing management
  - e. Insurance
- 9. Compliance & Conflict Resolution
  - a. Auditing and monitoring process
  - b. Non-compliance
  - c. Appeal process
- 10. Disaster recovery Plan
  - a. Contingency procedures
  - b. Procedures/responsibility for system restoration
  - c. Levels of response

## **STANDARDS FOR OPERATIONAL MANAGEMENT**

The purpose of these Standards is to define each agency's role in the operational management of the Statewide Shared Digital Trunking System.

Each User of the System will formally designate a Local System Administrator (LSA) who will have the authority to represent their respective Agency(s) interests and make decisions on issues related to the day-to-day operation on their portion of the system and any urgent or emergency system operational or repair decisions. The MnDOT System Administrator will represent the statewide infrastructure portion of the system. Each LSA shall designate a backup who shall have the authority to represent their respective portion of the System in the absence of the primary LSA.

An urgent or emergency situation would be one where immediate decision authority is needed to allow the System as a whole, or any of the Subsystem components, to continue supporting normal wide-area communications services. It is recognized that each Local Systems Administrator (LSA)

may have to obtain authorizations from higher levels of their own organization to make longer-term

or non-emergency capital or repair expenditure decisions.

Each LSA will be responsible for the day-to-day management, operation and oversight of the system components within their portion of the System. Specific duties will not be detailed in this document. However, the general duties will include, but are not limited to, the following:

1. Monitoring the system and its components for normal operations.
2. Participating in the diagnosis of system performance problems and the development of corrective action recommendations.
3. Dispatching appropriate repair services in the event of a malfunction in the system equipment.
4. Managing the database elements including Subscriber IDs, talk group IDs, and the various parameters that relate to their effective operation.

Due to the complexity and distributed administration & maintenance of the System, typical problems can appear when changes are made to hardware or software.

In order to keep all representatives informed of any updates, notifications will need to be sent to all primary & alternate Local System Administrator (LSA) representatives in the event of any of the following:

- a. Any planned maintenance work being done on the Statewide or Local Systems that would affect the System performance for the other users would be preceded with reasonable notification of the maintenance work being done.
- b. Any equipment malfunctions or failures that would affect system performance for the other users of the local systems or statewide system.
- c. Any configuration changes in equipment or software by any one of the users that may affect system performance for the other users.

In addition to the responsibilities as a Statewide System Administrator, the MnDOT System Administrator will also be responsible for:

- a. Arranging for System Administration meetings at least monthly to review operations of the System and share ideas or issues that have arisen in local subsystems that may be of interest to the other Local System Administrators.
- b. Being available to work with any of the other Local System Administrators or the technical staff of any of the local systems to diagnose and resolve any system operational problem that involves parameter changes, maintenance or repair of the regional equipment.
- c. Being the identified point of contact with the vendor for issues related to the statewide network equipment.
- d. Providing timely information to the other Local System Administrators on any System issue that arises or repair/maintenance issue related to the system equipment.
- e. Monitoring the performance of the entire network for normal operations, particularly the performance of the statewide infrastructure equipment.

- f. Monitoring the configuration of the system database for normal operations, particularly the properties of the statewide equipment & database objects. And conducting the periodic database backups.

The Local System Administrators along with Mn/DOT's System Administrator will be the representatives forming the System Managers Group (SMG). The SMG is responsible for the operational management of the entire statewide system.

## **STANDARDS FOR NETWORK MANAGEMENT**

The statewide network consists of, but not limited to, channel banks, hubs, switches, routers, servers, Local Area Networks at the equipment locations, and Wide Area Links connecting sites together consisting of the microwave & fiber optic equipment, and the network management tools provided by the equipment manufacturer.

The System architecture is primarily constructed around an Internet Protocol based network. The network is composed of industry standard equipment, which also provides flexibility and a large variety of management & diagnostic tools.

The vendor will provide equipment configuration information as part of the system documentation. The system network is complex and unusual problems may be difficult to identify and resolve. The system documentation will have to be kept up to date or will lose its value in supporting the system network.

The system network is protected from other agency data networks, and shall remain so. This is to protect the security and functionality of the system. If there is a connection to another data network, it shall be through an appropriately designed & maintained firewall.

The components of the network shall be considered as "owned" by the State of Minnesota, unless otherwise designated as a local component. In which case that component would be owned by the local unit of government. The individual owners will then be responsible for the maintenance of the sites & equipment that they own. Agreements between the Owners and/or Maintenance Contractors are at each agency's discretion, but the Owner is still ultimately responsible for their portion of the system.

The Backbone system is structured on an integrated network; any infrastructure hardware and software upgrades or changes that may impact the system network will need reasonable discussion and subsequent approval by the System Managers Group.

All maintenance work being scheduled that may affect the statewide system and/or a local system performance shall be preceded by reasonable and appropriate notification to the other Local System Managers.

The equipment configurations of the components of the network will need to be documented. This is primarily for the purpose of maintenance, but also affects future planning. The vendor will provide the original "as built" documentation.

The methods for performing detailed network operations will be defined in the technical resource manuals and training for the system. The technical resource manuals will be classified as "Security

Information” and “General Non-Public Data” pursuant to Minn. Stats. §13.37 Subd. 1a.

The details on procedures not otherwise defined will be at the discretion of the System Managers Group.

The Mn/DOT System Administrator and Local System Administrators are responsible for managing the data attributes that they are individually responsible for. The MnDOT System Administrator shall be responsible for the statewide portion of the network.

## NETWORK ARCHITECTURE

### PROJECT 25 STANDARDS

APCO Project 25 is a joint effort of U.S. federal, state, and local government, with support from the U.S. Telecommunications Industry Association (TIA). State government is represented by the National Association of State Telecommunications Directors (NASTD) and local government by APCO. The standards process is called “APCO Project 25” and the standards themselves are called “Project 25.” Of the three groups of users, APCO (i.e., local government) members are the largest group of users of Land Mobile Radios (LMR).

The primary objectives of the APCO Project 25 (P25) standards process are to provide digital, narrowband radios with the best performance possible, to meet all public safety user needs, and to permit maximum interoperability. Secondary objectives include obtaining maximum radio spectrum efficiency, ensuring competition throughout the life of systems, and ensuring that equipment is user-friendly. During the process, the needs of the user have been put first. Performance and meeting user needs were always placed higher in priority than spectrum efficiency or reducing technical complexity.

The Project 25 documents were developed by TIA, based on user needs, and then approved by the APCO Project 25 Steering Committee (representing federal, state, and local governments) before being published as TIA documents.

Project 25 Phase I (12.5 kHz bandwidth) is essentially complete, 30 of the 32 Phase I Project 25 documents have been published by TIA, containing more than 1,800 pages of technical information. The two remaining documents are on inter-sub-system interface conformance and network management conformance. These documents are expected to be published shortly.

The basic characteristics of Project 25 radios are these:

- ?? a Phase I emission designator 8K10F1E (C4FM [compatible four-level frequency modulation]) for operation in a 12.5 kHz channel and a Phase II emission designator of 5K76G1E (CQPSK [compatible quadrature phase shift keying]) for operation in a 6.25 kHz channel.
- ?? use of a common receiver for both C4FM and CQPSK to ensure full interoperability between the two signals.
- ?? encryption defined for the U.S. Data Encryption Standard (DES) algorithms, but other techniques can also be employed.
- ?? use of an IMBE (improved multiband excitation) vocoder with 4400 bits/s of digitized voice, 2800 bits/s of error correction on the voice, and 2400 bits/s of signaling overhead, for an aggregate bit rate of 9600 bits/s.

**Project 25 Migration Strategy and Phase II Plans** Project 25 has a well-planned migration strategy, both in the forward and backward direction. It was assumed in the basic planning that (1) no virgin spectrum was available and (2) users would need to effect a gradual phase-in and phase-out of equipment.

For the transition from 25-kHz to 12.5-kHz digital, all Project 25 Phase I radios will be capable

of both 25 kHz analog FM and 12.5-kHz digital C4FM operation. Radios can thus be procured gradually, and channels or talk-groups converted to P25 operation whenever all the radios on them are P25

The primary track of Project 25 Phase II has been announced to be 6.25-kHz CQPSK. The only difference between Phase I C4FM and Phase II CQPSK is the modulation method in the radio transmitter. A smooth transition is possible since Phase I radios can be gradually replaced by Phase II radios. The Project 25 Steering Committee is currently receiving proposals for a secondary TDMA [Time Division Multiple Access] track for Phase II. Here are two requirements for such.

A TDMA radio:

- ?? to have a Phase I mode of operation (non-trunked minimum), for operation with other P25 radios.
- ?? to be able to patch digital audio (i.e., have a common vocoder) and signaling information to/from other P25 radios.

Other Standards Planned for Project 25 Phase II the U.S. Telecommunications Industry Association is pursuing standards for more than a basic radio air interface as a part of the APCO Project 25 Phase II standards process. One of these efforts is to develop a standard interface to consoles.

Another standard that TIA plans to develop as a part of Project 25 Phase II is a standard interface between repeaters and other subsystems (e.g., trunking system controller). This will allow users to purchase equipment from multiple manufacturers for a single site, rather than being locked into the offerings of any one company.

Users should consider their individual situation in making procurement decisions. Overall, the users in the United States have concluded that FDMA is the preferred solution for the vast majority of their needs.

Project 25 standards were designed primarily for the public safety user, with range and performance given high priority. Also, unique flexibility has been designed into the standards to enhance interoperability, privacy, gradual phase-in of new technologies, and the reliable

transmission of voice and data. Several other of the seven techniques provide greater spectrum efficiency, and several are less complex (with potentially lower costs). However, the Project 25 Steering Committee believes none of the others provides greater performance, at greater range, or has more public safety-oriented features.